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## PEDESTRIANS' SAFETY IN POLAND AND USE OF REFLECTIVE MATERIALS

**Summary.** The subject of pedestrian safety is particularly important in Poland, where the risk of mortality is very high compared to other European Union (EU) countries. In Poland, 60% of all killed pedestrians lost their lives at night, mostly away from urban areas. The current article focuses on pedestrians' compliance with the law requirements of the mandatory use of reflective elements at night in non-urban areas since its introduction in Poland in 2014 based on a data analysis and survey on pedestrians' attitudes and behaviours. An analysis of pedestrian accidents, fatalities, and serious injuries at night five years before and five years after 2014 showed an improvement in pedestrian safety more in non-urban areas (where the law on reflective elements is obligatory) than in urban areas. This study is the first published work to present comprehensive results from an in-depth national survey about people's attitudes and behaviours regarding the use of reflective elements. The data were obtained from 600 observed and 400 questioned pedestrians in 2018. Observations from 2018 showed that only 21% of pedestrians respected the obligation to wear reflective elements at night outside urban, even though 46% of respondents declared in questionnaires that they wore such elements. Pedestrians who used reflective devices in non-urban areas at night were mainly young people aged 40 years old or younger. They used reflective clothing (shoes, trousers, backpacks); 79% of observed pedestrians did not wear reflective elements at night according to questionnaires from 2018. More pedestrians (60%) who didn't use any reflective wore black clothing, which made them not visible to drivers and put them at risk of being killed. A comparison of the data showed a positive change in pedestrians' attitudes due to this obligation. In 2015 only 35% of respondents knew that the use of reflective elements was obligatory in some situations; in 2018, almost half of them (46%) did. The analysis carried out in the present study indicated that the preventive action of introducing the mandatory use of reflective elements at night by pedestrians outside urban areas has slowly improved the safety of pedestrians and decreased the numbers of accidents, serious injuries, and fatalities. Changes introduced into Polish traffic rules have improved pedestrians' safety on roads since 2014; however, there is still an immense need to carry on social actions and campaigns promoting the use of reflective elements to educate road users to change pedestrians' behaviours.

### 1. INTRODUCTION TO PEDESTRIANS' RISKS AT NIGHT

Statistics related to road accidents and pedestrians' safety in previous years indicates a high risk of fatalities and injuries [1]. The high risk of pedestrians is a result of mixed factors, including poor lighting (or no lighting) on roads, pedestrian crossing facilities, and drivers' risky behaviours,

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including excessive speeding. Pedestrians, as the perpetrators and victims of road accidents, often engage in risky behaviours like walking in front of or behind moving vehicles, crossing the road in prohibited areas or at red lights, being distracted while crossing the road (e.g. listening to music or texting), or not making themselves visible – for instance, they do not use of reflective elements when visibility is limited. The risk to pedestrians on Polish roads has been one of the highest in the European Union (EU) for years. The death rate was 77 per million inhabitants in Poland in 2019, while the EU average was 51 [1]. The risk of death in Poland caused by road accidents is over three times higher than in the safest European country of Sweden (22 fatalities per million people). One of the most serious safety problems in Poland is the very high number of pedestrian fatalities and injuries. In Romania, Latvia, and Poland, the mortality rate for pedestrians in 2018 was at least two times higher than the EU average (10) and seven times higher than in Sweden or the Netherlands (Fig. 1).

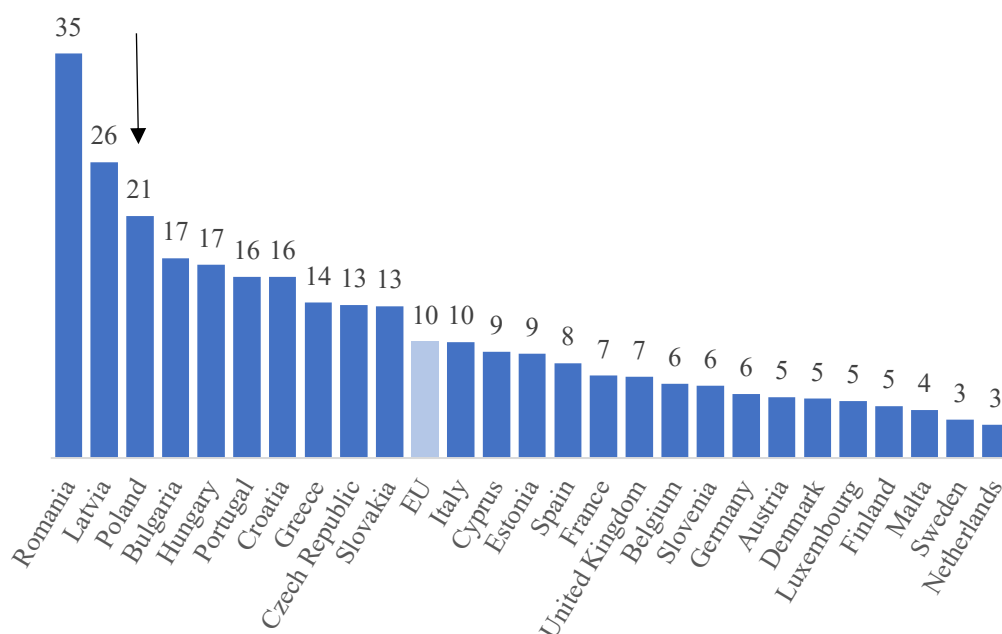


Fig. 1. Pedestrian mortality rates per million population by country in 2018 [1]

According to the European Road Safety Observatory of Community database on Accidents on the Roads in Europe (CARE database), Poland, among 27 EU countries from 2010-2018, exhibited the largest decline in the number of pedestrians killed on the road (-38%). Despite this, the country still reported the greatest number of pedestrian fatalities in 2018 (803), with above-average pedestrian mortality [3]. According to the Polish Road Safety Observatory, since 2011, pedestrians' risk has been decreasing in Poland but still accounts for about 30% of all fatalities (Fig. 2) and 20% of injuries. In 2019, 793 pedestrians were killed in road accidents, and 6 361 were injured, including 2 474 serious injuries [2].

A detailed analysis on data of the Polish Road Safety Observatory from 2019 due to time of the day and area of occurring on pedestrians' accidents and morality indicate the following: more accidents occurred during the day (55%), but more pedestrians were killed at night (60%) (Fig. 3). High pedestrian morality at night occurred in built-up areas (53% of those killed) but was more frequent in not built-up areas (73% of those killed) (Fig. 4) [4]. The percentage of pedestrian fatalities in areas with insufficient road lighting (i.e. and night, dusk, dawn, and twilight) varies between countries, from 74% in Lithuania to 28% in Finland; the EU average is 45% [5]. The data presented below show that the main risk to pedestrians is their poor visibility at night due to the lack of conspicuity aids.

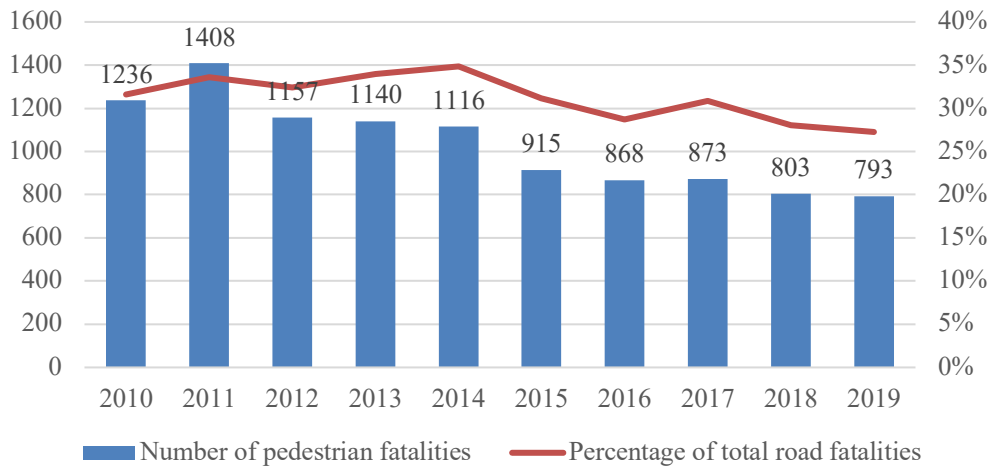


Fig. 2. Number of pedestrian fatalities and percentage of all road fatalities in Poland from 2010-2019 [2]

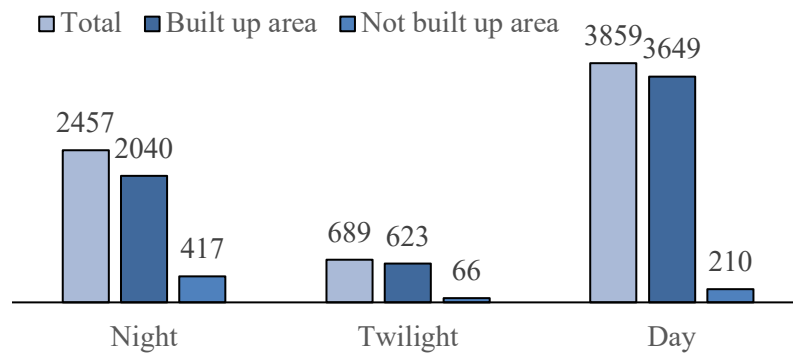


Fig. 3. Pedestrian accidents by lighting conditions and area in Poland in 2019 [4]

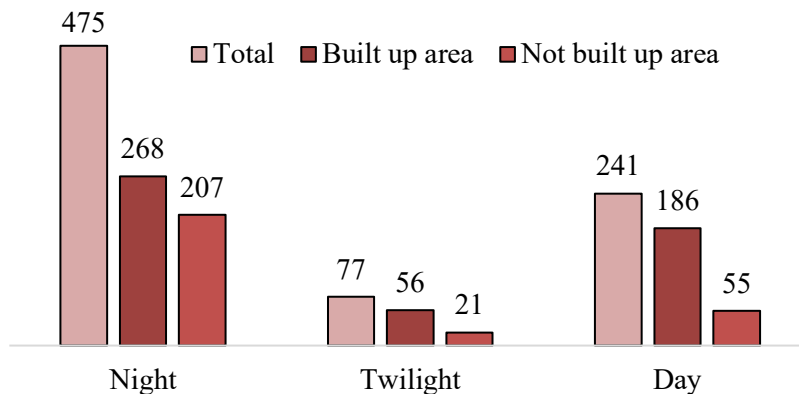


Fig. 4. Pedestrian fatalities by lighting conditions and area in Poland in 2019 [4]

The distribution of time and locations of pedestrian fatalities indicate peaks in the morning and evening, which could be associated with the absence of daylight. During the winter months (when it is more often dark), up to two times more travelling pedestrians are killed on the road than during the months of March to June. Darkness and a lack of lighting make pedestrians less visible to other road users, resulting in a higher rate of mortality [3]. The risk of road accidents drastically increases when it is dark. Up to 7.4 times more pedestrian accidents occur at night than during the day. Another analysis estimates that the risk of such accidents is 4-4.08 higher in darkness on roads with no street lighting and 1.95-2.00 on roads with lights [6].

An analysis of statistical road accidents data confirms an increased risk of road accidents in darkness [7]. Fatalities and serious injuries are more likely to happen in darkness, while slight injuries more often occur in daylight; thus, crashes at dusk are more severe than those during the day [8]. The risk of injury accidents associated with darkness was estimated based on accident data from Norway, Sweden, and the Netherlands. It was found that the risk of an injury accident increases by nearly 30% in darkness in urban areas and by nearly 50% in rural areas [9]. Another analysis shows that the risk of fatal accidents on national roads is about four times higher at night than in the day on rural roads and about 2.5 times higher on roads in built-up areas [6].

Data show that the main risk to pedestrians is poor visibility at night. Therefore, European Commission DG Move claimed [8] that the number of crashes involving pedestrians can be reduced through proper street lighting wearing reflective gear.

Studies have shown that pedestrians who wear reflective elements can be seen by car drivers at considerably farther distances than those who do not [10]. These materials can be highly visible from distances far greater than the distance it takes for vehicles to stop when travelling at high speed. Studies have confirmed that retro-reflective markers increase the visibility distance of pedestrians at night [11]. Using retro-reflective markers is important, but its position is also important. Retro-reflective markers on the limbs, in comparison to those on the torso, significantly increased the nighttime recognition distance of pedestrians (by about 60-80%). Using dipped headlights by vehicles, the detection distance on unlit roads increases from 25-40 m to 130-140 m. The detection distance increases to more than 400 m with full-beam headlights on [12]. Pedestrian reflective elements reduce the risk of pedestrians being hit by a car in the dark by around 85% [13]. This large reduction in the accident rate corresponds to the increased detection distance in the dark by using visible-pedestrian items. Colour is another important factor determining reflectivity. A black coat reflects only 5% of the light to which it is exposed, while a light coat reflects around 80% [13].

In some countries, there is a legal obligation for pedestrians to wear reflective materials when walking in the streets in the dark to make them visible to car drivers.

Since 31 August 2014, pedestrians walking along a road in not built-up areas after dusk in Poland [14] have been obliged to wear reflective elements visible to other road users, except when walking on roads designated for pedestrians or on the pavement. The mandatory usage of reflective elements is justified by the fact that night conditions are particularly risky for pedestrians, where every fourth accident results in a fatality (vs every ninth during the daytime). After dusk, the risk of losing a life on the road in an accident is two times higher than during the day. Many more accidents happen at night due to the inability of drivers to see a pedestrian walking along the edge of the road (especially when visibility is limited and there are no streetlights). Therefore, it was decided to extend the scope of the regulations on the use of conspicuity aids to all pedestrians – before 31 August 2014, the regulation obliged only children under the age of 15 to use reflective elements [15].

There are many definitions of pedestrians and walking. In modern times, the term pedestrian usually refers to someone travelling on foot during at least part of their journey. Sometimes, a pedestrian is a person who is running, jogging, hiking or even sitting or lying down in the roadway.

## 2. OBJECTIVE AND METHODS

The high risk of pedestrian fatalities in Poland (mostly in non-urban areas) at night is the subject of the analysis to be carried out in this paper. The purpose of the article is to assess pedestrians' compliance with the law requirements of mandatory use of reflective elements at night in non-urban areas since its introduction in Poland in 2014. Since 31 August 2014, the obligation to use reflective materials was introduced in Poland to save the lives of pedestrians walking at night on roads with no street lights by making walkers on roads more visible to vehicle drivers.

Three research methods are used in the paper to check how the new regulations on the use of reflective materials have been adopted:

1. Statistical analysis of pedestrian traffic safety in Poland five years before and five years after 2014 study comparing the number of accidents and killed and seriously injured pedestrians. Comparable data developed by the authors provides evidence that changes introduced in Polish traffic rules have improved pedestrians' safety on roads after 2014. The decrease in accidents is especially apparent in non-urban areas, where there is obligatory use of reflective materials.
2. An analysis of data from an on-site study on pedestrians' attitudes (questionnaires, declared opinions) on the use of reflective elements collected in 2018. A comparison between results from the first study in 2015-2018 was done to show changes in pedestrians' knowledge of their obligation to use reflective materials.
3. An analysis of data from an on-site study on pedestrians' observations (demonstrated performance) on the use of reflective elements in rural areas at night collected in 2018.

Statistical analysis, studies on pedestrians' knowledge and demonstrated performance on the usage of visible elements in real traffic conditions showed their high risk of deaths at night. This was the reason to introduced on 8 August 2014 in Poland mandatory usage of reflective materials by pedestrians walking outside built-up areas at darkness. In the article was carry out evaluation of pedestrian' s risk before and after 2014, where the implementation of new rules was imposed. The justification for undertaking this research topic is the high risk of pedestrians, indicated by statistical data on road accidents in EU countries (CARE database, Fig. 1) in Poland, where the risk to pedestrians is higher at night than during the day (Polish Road Safety Observatory, PRSO database, Figs. 2-4).

The authors of the present article prepared a dedicated statistical analysis on pedestrians' accidents and casualties in Poland from 2009-2019 based on data from PRSO. Data for five years before and five years after 2014 showed changes due to the introduction of regulations aimed to improve pedestrian safety by wearing reflective elements in non-urban areas at night, where their morality is higher than in urban areas.

Table 1 presents data from before and after the introduction of a new traffic rule in Poland in 2014 (Tab. 1, Figs. 5, 6) [4]. This type of analysis answers the question of whether the introduced changes (new traffic rules) have improved the safety of road users (e.g. whether the number of fatalities has declined) and shows what still needs to be improved.

**The statistical analysis** of pedestrian traffic safety in Poland was the first research method used in this paper to show whether the new law regulations on reflective use was adopted by pedestrians on roads where are no streetlights (non-urban areas). An analysis of pedestrian accidents, fatalities, and serious injuries at night was done for the five years before 2014 and five years after 2014 (i.e. the year of the introduction of the obligatory use of reflective elements) (Tab. 1, Figs. 5, 6). The average annual numbers of accidents and casualties of five years before 2014 were compared to the average annual numbers of accidents and casualties after 2014. Data from built-up areas (where there is no obligation to use this kind of preventive measure) were compared to data from not built-up areas (which are subject to the new regulation).

The data in Figs. 5 and 6 clearly indicate a decrease in the numbers of accidents, fatalities and seriously injured after 2014 when the use of reflective elements at night in not built-up areas than in built-up areas of Poland was made mandatory.

Apart from the statistical analysis showing how the mandatory law on usage of reflective materials is followed by pedestrians in Poland walking in non-urban areas, in-depth studies were conducted. In this context, the present paper presents the results of a survey on pedestrians' attitudes (declared opinions) and behaviours (observations) in Poland in 2018 due to this obligation [16]. These results were compared with results from the first study on pedestrians' attitudes about using reflective materials carried out in 2015 in two voivodships of Poland as a pilot study [17]. The methodology developed in the pilot study for systematic studies on pedestrian behaviour and pedestrian and driver behaviour was used to carry out research in 2018. The data collected by the authors of the paper in 2018 were compared to the results of the study first carried out in Poland in 2015. A study on pedestrians' attitudes and behaviour carried out in 2018 was part of widely national research on pedestrians' behaviour and driver-pedestrian relations carried out by the Motor Transport Institute [16].

Table 1  
Pedestrian road accidents at night before and after the introduction of reflective elements' usage in Poland since August 2014, time changes 2009-2019 [4]

Year	Accidents		Fatalities		Seriously injured	
	Built-up area	Not built-up area	Built-up area	Not built-up area	Built-up area	Not built-up area
2009	3525	848	488	375	1183	226
2010	2912	790	414	326	912	220
2011	3217	845	486	381	1106	227
2012	2861	774	386	318	1073	212
2013	2729	686	372	315	976	183
<b>2014</b>	<b>2674</b>	<b>628</b>	<b>372</b>	<b>294</b>	<b>941</b>	<b>179</b>
2015	2619	557	320	250	989	168
2016	2705	507	302	220	1070	157
2017	2458	452	278	214	929	124
2018	2171	438	279	187	824	144
2019	2040	417	268	207	762	115
annually BEFORE	3049	789	429	343	1050	214
annually AFTER	2399	474	289	216	915	142
BEFORE / AFTER	-21%	-40%	-33%	-37%	-13%	-34%

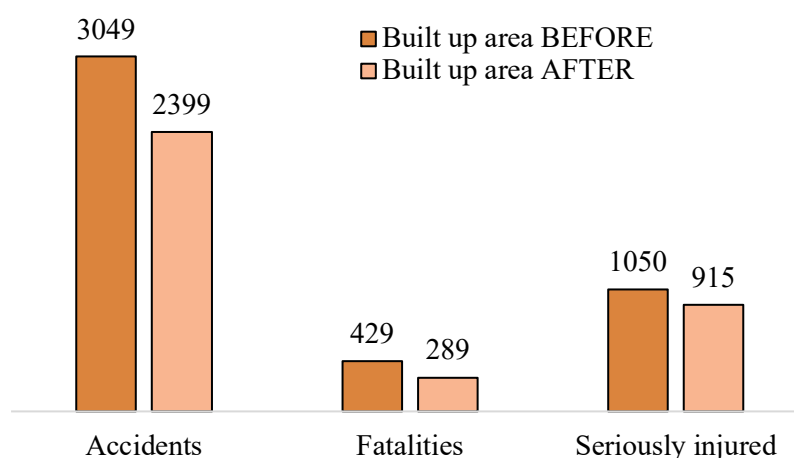


Fig. 5. Before and after changes on the introduction of reflective elements' use at night in built-up areas [4]

The next two methods of research used in the paper focused on field surveys on pedestrians' attitudes and observations on their use of reflective elements outside built areas at night according to the methodology developed in 2015.

The research was conducted in four voivodships of Poland in 2018. The selection of voivodships chosen to conduct the study was made based on the general state of road safety and the proportion of accidents involving pedestrians among the total number of accidents in each voivodship of Poland in 2017. Four voivodships were chosen as representative of the whole country, with a very high percentage of pedestrian accidents occurring in Silesian, the highest share in Mazovia, a middle share in Greater Poland, and a small percentage in Lodz. Almost half of the road accidents involving pedestrians in Poland in 2017 took place in these four voivodships. The analysis of the cumulative results has enabled the collection of enough data to formulate comprehensive conclusions for the whole country.

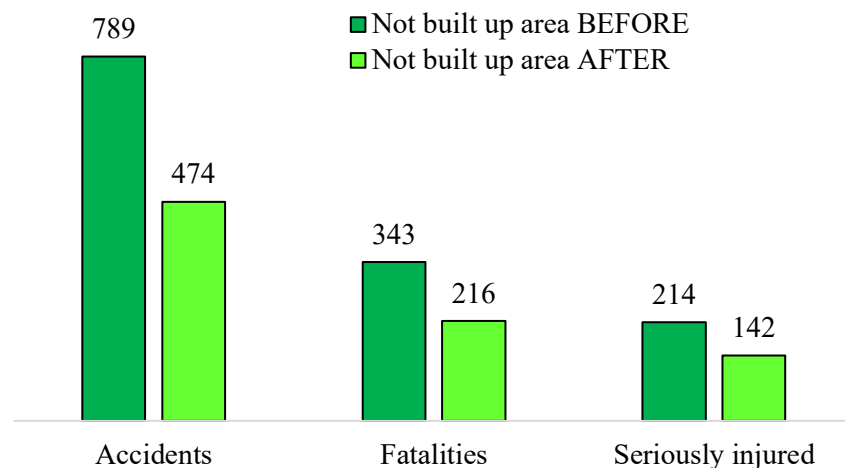


Fig. 6. Before and after changes on the introduction of reflective elements' use at in not built-up areas [4]

**The opinion survey** on knowledge about mandatory law regulation on the use of reflective elements among pedestrians was the second research method used in the paper to show whether the regulation from 2014 was adopted by pedestrians in darkness outside urban areas in 2018.

Each interviewed pedestrian was asked the following questions:

- Do you know that the use of reflective elements by pedestrians is obligatory in certain situations?
- If you know that use of reflective elements is obligatory, in what places/situations have you worn them?
- Do you use reflective elements as a pedestrian?
- If you use reflective elements as a pedestrian, in what places/situations have you worn them?
- If you do not use reflective elements as a pedestrian, why not?
- How often do you walk along the road after dark?

During the survey on pedestrians' attitudes, over 400 questionnaires were collected from four voivodships in Poland in 2018, including 181 from large cities and 241 from small towns and not built-up areas. The characteristics of questioned pedestrians were as follows: 51% women, 49% men, mostly between 20 and 40 years old, and 64% of respondents had a driving license. The survey was carried out in 30 locations near the area of zebra crossings. Specialised interviewers (groups of three pollsters in each voivodship) conducted interviews in person on research fields using specially prepared questionnaires. The pollsters asked the questions and noted the answers on a sheet with a printed questionnaire. The survey used interviews of quantitative method of PAPI (Paper & Pen Personal Interview). The methodology of questionnaire surveys first adopted in 2015 was adopted and repeated in the survey in 2018.

The third research method used in the paper was **on-field pedestrians' observations** on the use of reflective elements. Observations aimed to determine how the regulation of the obligatory use of conspicuity aids is in real traffic respected by pedestrians and what kind/form of elements they use. Type of retro-reflective items as reflective vests, bands, dangle tags, armbands, strips on bags, reflective elements on garments (sweatshirt, trousers, jacket, shoes, backpack) and flashlights' usage was checked. Research based on observations was conducted after dusk on 21 road sections of not built-up areas (where it is compulsory for pedestrians to use conspicuity aids). Observations were carried out on roads with a large diversity of road classes in terms of pedestrian and vehicle traffic volume, density of buildings, and population. Pollsters noted pedestrians' behaviours due to the information about the colour of their clothing and the type of reflective elements used. Observers filled in a specially prepared questionnaire regarding information about the pedestrians. They examined the manner of the pedestrians' behaviours (colour of clothing, use of reflective elements, method of movement, if on the right side of the road) and the characteristics of the road.

Observations were made from October to December 2018 after dusk (no earlier than two hours after the calendar sunset and no later than two hours before the calendar sunrise). The study was conducted in five counties in each of the four studied voivodeships. The minimum research sample for each voivodeship was 150 observed pedestrians. The total number of observed pedestrians was 600 (400 men and 206 women). Only 10% of the observed pedestrians were aged 65+, and only 16% were under 20 years old. The most represented age group (44%) were people aged 20-40 years old; those aged 40-60 years made up 30% of the sample.

### 3. RESULTS

This section of article results presents the comparable statistical data [4], results from a nationwide study on pedestrians' attitudes carried out in the form of questionnaires and observations from onsite study fields in Poland in 2018 [16], and a comparative analysis of pedestrians' attitudes from the pilot study in 2015 and the study in 2018 [17].

The authors prepared **comparable statistical data** for five years before 2014 and five years after 2014 on the numbers of pedestrian accidents, fatalities, and serious injuries. The data indicates that changes introduced into Polish traffic rules have improved pedestrians' safety on roads since 2014. The decrease is especially apparent in non-urban areas, where the use of reflective materials is obligatory. The analysis indicates decreases in the annual average numbers of pedestrian accidents (by 40%), fatalities (by 37%), and serious injuries (by 34%) in rural areas since 2015. (Tab. 1, Figs. 5, 6). Results from the on-site study on pedestrians' attitudes (questionnaires, declared opinions) on the use of reflective elements collected in 2018 were presented (Figs. 7-12).

The **questionnaire** survey shows that the vast majority of pedestrians (75%) know that, in some situations, the use of reflective elements is mandatory. More than half of pedestrians (66%) indicated correctly that the use of reflective elements/materials is obligatory after dusk in not built-up areas (60%) (Fig.7).

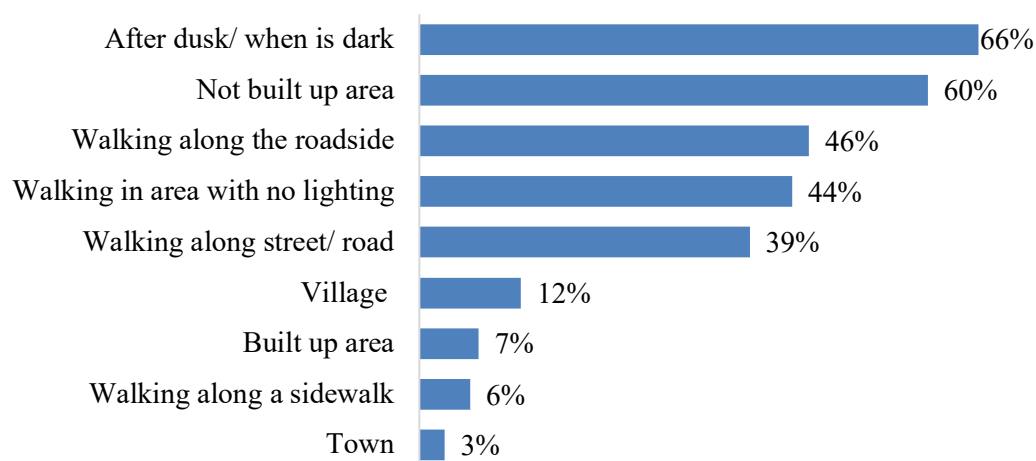


Fig. 7. Respondents' declared opinions. Answers to the question, "Do you know the use of reflective elements is obligatory, in what places/ situations?" [16]

Less than half of the respondents (46%) declared that they use reflective elements while walking as a pedestrian, according to the results from the survey on pedestrians' attitudes from 2018. The reason for this small percentage is that many respondents never, very rarely, rarely, or sometimes walk after dusk. Almost 78% of respondents did not regularly walk after dusk (Fig. 8).

Pedestrians who declared that they do not wear conspicuity aids (78%) were mostly unable to give areas on. Only 17% of questioned pedestrians did not know about the mandatory use of reflective materials, and only 6% expressed that they do not think reflective elements improve drivers' ability to see pedestrians (Fig. 9).



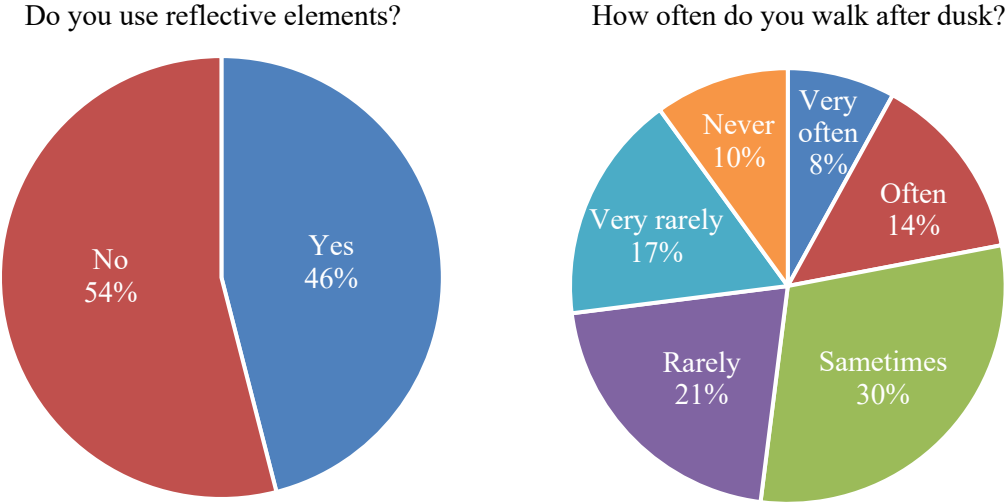


Fig. 8. Respondents’ declared opinions. Answers to the questions, “Do you use reflective elements?” and “How often do you walk after dusk?” [16]

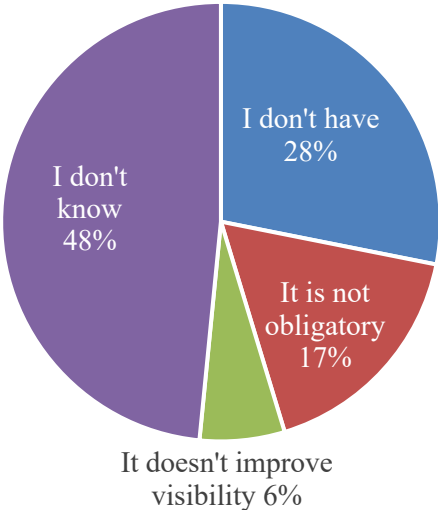


Fig. 9. Respondents’ declared opinions. Reasons why pedestrians do not use elements [16]

It was found during **on-field observations** that the opinions and attitudes expressed in questionnaires during the interview were different from observed behaviours in real traffic on the road. During the interview, 54% of surveyed pedestrians declared that they do not use reflective materials; however, the observations show that 79% of pedestrians do not use them. Furthermore, 60% of pedestrians who do not wear any visible elements additionally wear black clothing (60%), which makes them hard to see on the road, putting them at high risk of getting hit by a vehicle. Pedestrians who wear dark clothing while walking along the road without street lighting are not visible to drivers at a long distance. Therefore, drivers cannot properly react to them, slowing down not to put the pedestrian at risk of being hit (Fig. 10). The main visible elements used by pedestrians are incorporated in clothing. However, it is impossible to determine whether the use of retro-reflective incorporated in clothing is a deliberate action or whether it simply results from the inability to separate the luminescent element from the rest of the clothes and accessories (e.g. patches on jackets, backpacks, or shoes) [16].

Reflective elements were mostly used by young people under 20 years old (32%) and by people aged between 20 and 40 (22%) (Fig.11). This should be considered as a positive phenomenon, as those groups of pedestrians are the most exposed to the possibility of being involved in a road accident. A

relatively high proportion of young people used reflective elements permanently incorporated in their clothes (13%). A large portion of clothes, mostly sportswear and accessories for young people available on the market, is equipped with reflective elements (e.g. backpacks) (Fig. 12).

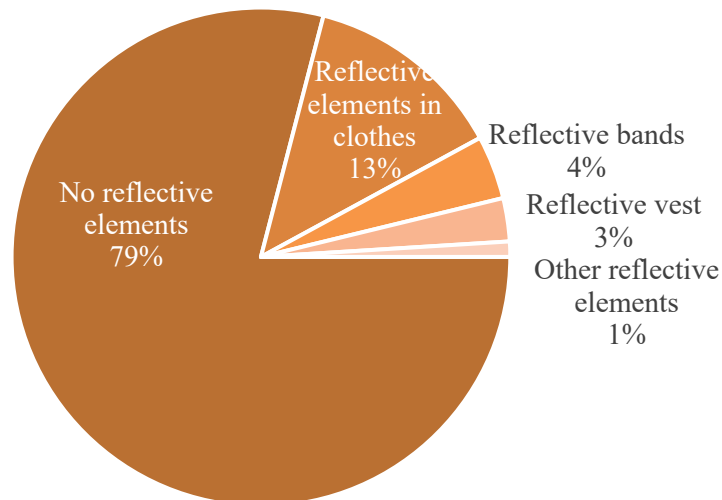


Fig. 10. On-field observations. Usage of reflective elements outside built areas at night [16]

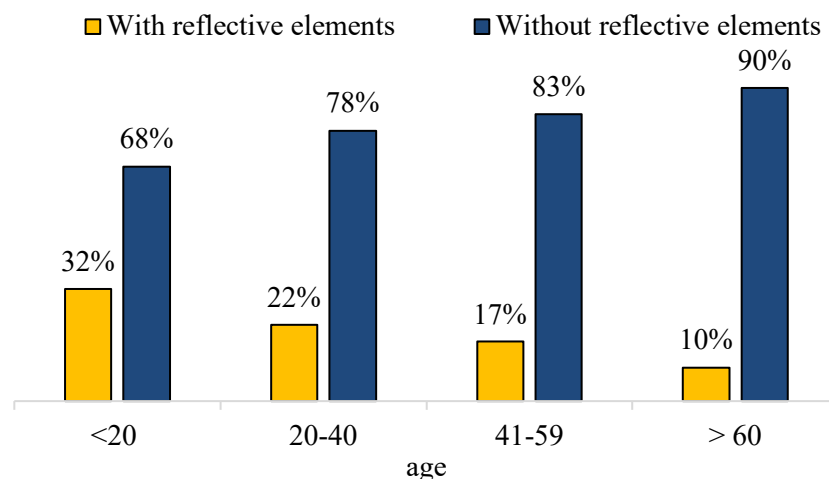


Fig. 11. Results of observations in 2018. Usage of reflective elements according to the age of the pedestrian [16]

Three per cent of pedestrians did not have reflective elements but used flashlights to be visible on the road during darkness due to the report from pedestrians' attitudes and observation in 2018. Flashlights do not meet the requirement of the law on the use of reflective elements.

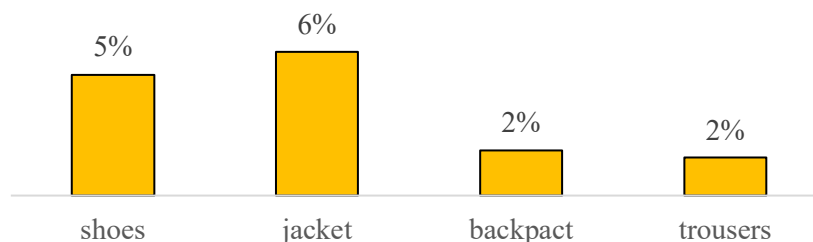


Fig. 12. On-field observations. Pedestrians' reflective elements incorporated in cloths and accessories [16]

The on-field observation of pedestrians demonstrated behaviours in traffic and survey on their knowledge toward regulation on compulsory use of reflective elements while walking along the road

without proper lighting in not built-up areas in 2018 have been conducted. Results of this showed that 46% of respondents were aware of the obligation and declared that they wear protective items. However, observations on pedestrians' mandatory usage of reflective materials in not built-up areas at night in 2018 showed that 79% of pedestrians did not respect the regulations by not wearing any reflective materials. Reflective materials incorporated in clothes are mainly worn by young people and those aged under 40 years old. A comparison of the results from the survey from a pilot study in 2015 versus a nationwide survey from 2018 was made. Pedestrians' knowledge of this mandatory law from a survey in 2015 showed that only 35% knew it, but 75% of respondents knew it in 2018. Over three years (from 2015-2018), there was an increase of almost 50% in respondents' knowledge of this rule.

Presented in the article of the comparative statistical analysis before and after 2014 analysis that there was an average drop in the annual number of accidents and casualties at night. There was a substantial drop of 4-20 percentage points more in not built-up areas than in built-up areas, where there is no obligation to wear reflective materials.

The results of the analysis indicate the need for further monitoring of pedestrians' high risk of morality on Polish roads by conducting a survey on their attitudes and behaviours, as well as analyzing data on accidents and casualties in the future.

#### 4. CONCLUSIONS AND DISCUSSION

The research methods presented in the article include statistical studies and a survey on the attitudes and behaviours on important topics of road safety among different road users, which have been widely used for many years. Statistical analysis on the numbers of accidents and killed and seriously injured pedestrians are very common research methods to evaluate road safety. The European Road Safety Observatory gathers information on road safety practices and policies in European countries and safety performance indicators based on national in-depth accident data. The Road Safety Observatory uses the CARE database, which is the only existing disaggregated pan-European accident data set [18]. It corresponds with national databases like the Polish Road Safety Observatory (PRSO). Data from PRSO were used to create dedicated analysis to present changes in pedestrians' safety after the traffic regulation was introduced on 31 August 2014, making the use of reflecting elements mandatory while walking at night outside urban areas in Poland. Surveys on attitudes and observations of road users are more detailed, in-depth methods of analysis to give insights into the problems of road safety, allowing an evaluation of the undertaken initiatives aimed at improvements.

The best-known survey on road users' attitudes, opinions and behaviours is the ESRA (E-Survey of Road users' Attitudes). The ESRA has existed for a long time, and with each new edition is collecting and analysing more comprehensive data of road safety culture and behaviour in more countries. The ESRA is a joint initiative of road safety institutes, research centres, public services, and private sponsors from all over the world, and the Motor Transport Institute for years actively works for it. Collected and analysed data by the ESRA was used as a basis for a broad set of road safety indicators. The latest edition (ESRA2) on pedestrians' attitudes from 2018 included self-declared behaviour, attitudes and opinions targeted on unsafe traffic behaviour, enforcement experiences and support for policy measures. ESRA2 collected answers through online panel surveys, using a representative sample of the national adult populations per at least 1000 participants in each participating country (32) from more than 35 000 road users [19].

According to the ESRA's 2018 Thematic Report on pedestrians' declared opinions due to the support or oppose a legal obligation to require pedestrians to wear reflective material when walking in the street in the dark, 79.8% of respondents from Poland expressed their support. Poland was in a group of several countries with the highest proportions of respondents supporting this law (along with Slovenia with 84.9%, Finland with 81.8% and Hungary with 79.4%). At the time the survey was carried out, the obligation for pedestrians to wear reflective materials when walking in the streets in the dark was introduced only by Serbia. In Poland, the Czech Republic, Hungary, and Spain, this obligation is only valid outside built-up areas.

ESRA2 gathered opinions on other topics related to road safety – for example, the risk of being involved as a pedestrian in road crashes in which the respondent or somebody else had to be taken to the hospital. According to the participating respondents from Poland, the risk is rather high, as in Australia or United States. Polish pedestrians expressed not feeling very safe on surveys regarding walking during the last 12 months on roads in Poland.

The results of this research, together with the still very high risk of pedestrians at night, indicate that the theoretically correct and effective solution (mandatory regulation) does not bring the expected improvement in safety due to the small share of people using reflective elements in Poland. Reflective elements used by pedestrians are the most cost-effective measure to reduce pedestrian casualties, and they are highly recommended by all road safety authorities. However, they are not the only elements that can be used to reduce pedestrians' risks. Other methods include better lighting of roads, design of pedestrian crossings, public transport stops, and lower vehicle speeds. An increased proportion of active forms of transport is required to pay more attention to reorganizing the traffic environment so that pedestrians can feel safer.

Data from the survey clearly indicates stronger enforcement on compulsory use of reflective elements is needed together with educational actions and social campaigns promoting the most cost-effective, simplest preventive measure (i.e. reflective elements), which reduce the risk of pedestrians and other vulnerable road users from being hit by car in the dark by around 85%. Conducting a systematic survey (using in-depth naturalistic observation technique: observation and questionnaire) allowed us to monitor changes in the attitudes and behaviours of all groups of road users, compare the results over time, and introduce countermeasures to improve traffic safety. Improving the effectiveness of preventive actions aimed at reducing the risks to pedestrians in traffic would have a significant impact on the overall road safety level in the country.

The aim of ESRA research and that presented in the analysis in this article is to provide scientific evidence for policymakers at international and national levels on the topics most relevant to road safety. This type of research can be carried out according to the adopted methodology over a long period to allow comparisons of data, evaluations of countermeasures, and indications of the solutions needed to improve the safety of pedestrians and other road users on the road network.

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